Claims

[c1] What is claimed is:

1. A solder-film manufacturing method, being a process for multi-laminating unit layers formed by laminating a plurality of types of laminae made from either Zn, Bi or Sn singly, or an alloy composed of two metals selected from Zn, Bi and Sn.

[c2] 2. A solder-film manufacturing method as set forth in claim 1, wherein the unit layers are constituted substantially from Zn, Bi and Sn.

[c3] 3. A solder-film manufacturing method as set forth in claim 2, wherein the laminar structure constituting the unit layers is substantially the same in each unit layer.

[c4] 4. A solder-film manufacturing method comprising:
a process of forming a single lamina selected from a Zn lamina, a Bi lamina, an Sn lamina, an alloy lamina of Zn and Sn, and an alloy lamina of Bi and Sn;
a process of forming a unit layer composed of Zn, Bi and Sn by repeating the single-lamina formation process with the lamina being changed, and laminating the laminae; and

a process of repeating the unit-layer formation process to laminate the unit layers.

[c5] 5. A solder-film manufacturing method as set forth in claim 4, wherein the process of forming the unit layer comprises the steps of forming laminae in either the order Zn lamina, Sn lamina, Bi lamina, Sn lamina, or in the order Bi lamina, Sn lamina, Zn lamina, Sn lamina.

[c6] 6. A solder-film manufacturing method as set forth in claim 4, wherein the process of forming the unit layer includes the step of forming an alloy lamina of Zn and Sn, and/or a step of forming an alloy lamina of Bi and Sn.

[c7] 7. A solder-film manufacturing method as set forth in claim 1, characterized in including a step of forming an Sn lamina on the epi-surface layer of the solder film.

[c8] 8. A solder-film manufacturing method as set forth in claim 4, characterized in including a step of forming an Sn lamina on the epi-surface layer of the solder film.

[c9] 9. A solder-film manufacturing method as set forth in claim 1, wherein the unit layers are formed by vapor deposition.

[c10] 10. A solder-film manufacturing method as set forth in claim 4, wherein the unit layers are formed by vapor de-

position.

[c11] 11. A solder-film manufacturing method as set forth in claim 1, wherein the unit layers are formed by plating.

[c12] 12. A solder-film manufacturing method as set forth in claim 4, wherein the unit layers are formed by plating.

[c13] 13. A solder-film manufacturing method as set forth in claim 1, wherein the unit layer thickness is 8000 Å or less.

[c14] 14. A solder-film manufacturing method as set forth in claim 4, wherein the unit layer thickness is 8000 Å or less.

[c15] 15. A solder-film manufacturing method as set forth in claim 1, including a step of forming a solder film on a patterned resist layer, and patterning the solder film by a lift-off technique after the solder film is formed.

[c16] 16. A solder-film manufacturing method as set forth in claim 4, including a step of forming a solder film on a patterned resist layer, and patterning the solder film by a lift-off technique after the solder film is formed.

[c17] 17. A heat sink furnished with a solder film manufactured according to the solder-film manufacturing method set forth in claim 1.

[c18] 18. A heat sink furnished with a solder film manufactured according to the solder-film manufacturing method set forth in claim 4.

[c19] 19. A heat sink furnished with the solder film set forth in claim 1, the heat sink being for bare-chip mounting of semiconductor devices.

[c20] 20. A heat sink furnished with the solder film set forth in claim 4, the heat sink being for bare-chip mounting of semiconductor devices.

[c21] 21. A heat sink furnished with a solder film being for mounting semiconductor devices mounted fluxlessly, the solder film being composed of Pb-free solder having a composition of 2 to 10 wt% Zn and 2 to 40 wt% Bi, with the remainder being Sn.

[c22] 22. A heat sink furnished with a solder film being for mounting semiconductor devices mounted fluxlessly, the solder film being composed of Pb-free solder having a composition of 3 to 9 wt% Zn and 2 to 14 wt% Bi, with the remainder being Sn.

[c23] 23. A heat sink furnished with a solder film being for mounting semiconductor devices mounted fluxlessly, the solder film being composed of Pb-free solder having a

composition of 5 to 7 wt% Zn and 8 to 14 wt% Bi, with the remainder being Sn.

[c24] 24. A heat sink furnished with a solder film being for mounting semiconductor devices mounted fluxlessly, the solder film being composed of Pb-free solder having a composition of 6 to 7 wt% Zn and 8 to 10 wt% Bi, with the remainder being Sn.

[c25] 25. A junction of a heat sink and a semiconductor device, including a heat sink as set forth in claim 21, and a semiconductor device mounted on the solder film furnished on the heat sink.

[c26] 26. A junction of a heat sink and a semiconductor device, including a heat sink as set forth in claim 22, and a semiconductor device mounted on the solder film furnished on the heat sink.

[c27] 27. A junction of a heat sink and a semiconductor device, including a heat sink as set forth in claim 23, and a semiconductor device mounted on the solder film furnished on the heat sink.

[c28] 28. A junction of a heat sink and a semiconductor device, including a heat sink as set forth in claim 24, and a semiconductor device mounted on the solder film furnished on the heat sink.